International Banking and Cross-Border Effects of Regulation: Lessons from Poland*

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The main goal of this paper is to determine whether foreign banks adjust their lending in Poland in response to changes to regulatory policy in their home countries. Poland, with its conservative, predominately foreign-owned banks concentrated on domestic activities, is an interesting case to study the existence of inward policy spillovers. Bank-level data and fixed-effect panel models are used to assess the impact of home-country regulations on the quarterly growth rate of lending to the domestic non-financial private sector. We especially focus on the changes in capital requirements, as they have been expected by Polish regulators to negatively affect the operations of foreign-owned banks in Poland. We find that tightening capital requirements in the home countries of Polish foreign-owned banks has a significant, negative effect on credit extension in Poland; however, when we also account for Polish regulations in this area, the impact of home-country changes is no longer significant, which suggests that local regulatory actions are more important for banks. We also document the impact of cumulative changes in prudential policies that differs depending on cycle conditions in the home countries of foreign-owned banks.

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1. Introduction

The increase in the number of regulatory actions across the globe (especially after the global financial crisis) has sparked concerns over the cross-border effects of such policies (see Buch and Goldberg 2017 for a review of the literature). This is especially important for many emerging economies which are hosts to international banks and therefore are highly vulnerable to potential cross-border deleveraging.[1] The aim of this paper is to verify the existence of inward policy spillovers in the Polish context and to determine whether international banks adjust their lending growth in Poland in response to changes in the regulatory policy in their home countries. This question is especially important from a Polish perspective, as the banking system in Poland is dominated by foreign-owned banks. Over the analyzed period (2002–14), the share of such institutions in the assets of the banking sector has never fallen below 50 percent. International banks operate in Poland mostly as subsidiaries of large banking groups; branches of foreign banks have never played a significant role in the Polish market, with their combined share in assets rarely exceeding 5 percent. At the end of 2014, the most important foreign-owned institutions were banks with headquarters located in Italy (13 percent of assets), Germany (10.3 percent of assets), Spain (9.1 percent of assets), and the Netherlands (9 percent of assets)—see Narodowy Bank Polski (2015). Such a structure leaves the Polish banking sector exposed not only to local (i.e., Polish) prudential regulations but also to home-country prudential policy that affects the functioning of the consolidated banking groups.

The potential regulatory spillovers have been debated in Poland, especially right after the outbreak of the global financial crisis and during the European Union (EU) negotiations about the CRDIV/CRR package. There were fears that the need to comply with tightened regulatory requirements after the crisis, together with the worsening financial situation of the banking groups, would affect the ability and willingness of Polish foreign-owned banks to extend

[1] For example, the report published by the Financial Stability Board (2016) notes that "Some EMDEs report continuing concerns about cross-border spillovers that may be reducing the presence and activities of global banks in their domestic markets. These concerns ... also reflect how home jurisdictions of hosted global banks are implementing the reforms."

credit to the local economy. The end of new foreign bank financing after the crisis was considered one of the key threats, and possible contagion channel in Poland and in other countries in the Central and Eastern Europe region.

There are several features of the Polish banking sector that make it a unique testing ground for regulatory spillovers. First, there is relatively big variation in the home countries of foreign banks operating in Poland. At the end of 2014, owners of Polish foreign-owned banks were from sixteen different countries. Since these countries differ in the intensity and timing of prudential actions, the spillover effect can be easily identified. At the same time, there are still some big domestically owned institutions that can be treated as a control group that helps in the identification process. Second, nearly all the activity of Polish banks is domestic, so the only policies that may directly affect their credit growth are those in the home countries of foreign-owned banks and Polish regulations (a lack of substantial foreign operations is the reason for choosing not to study outward transmission in this paper). Finally, the business model of Polish banks, both domestic and foreign owned, is conservative (assets consist mainly of loans granted to non-financial customers; operations on financial markets are not a significant part of their business activity), and therefore, by looking at credit extension we capture most of the variation in the bank activities.

Data for the study come from supervisory reporting. In principle, all types of commercial banks are included in the sample (foreign and domestically owned, subsidiaries and branches); however, several small adjustments have been made and some banks have been omitted to avoid the results being affected by outliers. All data were collected at the individual level.

The results of the study show that tightening capital requirements in home countries has a significant negative impact on credit extension in Poland; however, this effect is only significant when we do not explicitly control for the Polish regulations in this area. This means that foreign-owned banks have not contributed to a credit crunch in Poland in the sample period by transmitting changes in their domestic regulations into the Polish market.

The paper is structured as follows. First we present several facts about the Polish banking sector and describe the empirical

methodology and data. We then present our results, including various robustness checks. The paper ends with conclusions.

2. Empirical Methodology and Data

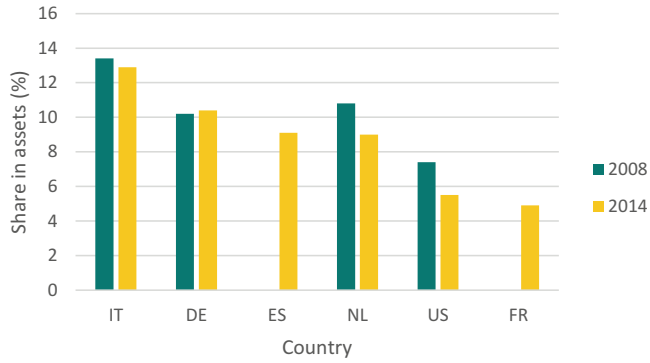
2.1 Stylized Facts for Poland

The high importance of the regulatory spillovers in a Polish context is a result of the dominance of foreign-owned banks in the banking sector. Any changes in the domestic regulations of such banks (i.e., changes in the regulations in their home countries) therefore potentially affect credit availability in the Polish economy, either directly (for example, if foreign-owned banks engage in cross-border deleveraging to meet stricter regulatory criteria imposed at the consolidated level) or indirectly (through the impact of regulatory changes on the economic condition of banks).

The role of foreign-owned banks in the Polish banking sector during the period analyzed has been evolving. Initially, their market share was rising as a result of the privatization process in Poland (similarly to other emerging countries, Poland decided to privatize most of its previously state-owned banks by selling them to the large multi-national banking groups that were able to provide adequate capital and know-how[2]). Since the outbreak of the crisis, there have been some adjustments along the extensive margin. A small number of foreign-owned banks decided to leave Poland (for example, Belgian KBC or Nordic Nordea), sometimes in response to government interventions in their home countries—for example, Irish AIB Group had to put its Polish subsidiary up for sale after receiving state support in Ireland. The buyers were either domestic banks or other foreign investors (for example, Santander bought a subsidiary in Poland from KBC). Such adjustments during the period analyzed have not been big—at the end of 2014 the share of foreign-owned banks was still high (over 60 percent of the total assets of the Polish banking

[2]Funding received from parent institutions helped Polish banks expand their activity during this pre-crisis period—for example, by granting mortgage loans denominated in foreign currency (available data suggest that it was foreign-owned banks that introduced such products to the Polish market; see Głogowski and Szpunar 2012).

Figure 1. Largest Foreign Investors in the Polish Banking System



Source: Data from the Polish Financial Supervision Authority.

sector compared with 72 percent at the end of 2008) and the number of countries from which owners of Polish banks originate remains stable (seventeen countries at the end of 2014, the same as in 2008), with the largest investors coming mostly from the EU (see figure 1).

Two types of regulations in home countries have been expected by policymakers to be particularly important for Polish foreign-owned banks—capital requirements and liquidity regulations (see Jakubiak 2012 and Kwaśniak 2012). Increased capital standards have been believed to lead to cross-border deleveraging, either in the form of reducing lending activity in other than domestic markets to reduce consolidated risk-weighted assets or by selling foreign subsidiaries. The initial proposals of the CRDIV/CRR package assumed centralized liquidity management in a banking group. From the perspective of host-country regulators, this created the risk of transferring the liquidity from subsidiaries to their headquarters and leaving Polish banks as dummy companies (see Gadomski 2011). Similar concerns reemerged in 2013 with the creation of the Single Supervisory Mechanism. The speech given in Dublin by Constancio (2013) was understood as an announcement of the forthcoming centralized capital and liquidity management in banking groups (see Narodowy Bank Polski 2014).

During the analyzed period, the operation of banks in Poland has also been influenced by a number of local prudential regulations

aimed at limiting excessive growth in lending to households (mainly mortgage related, such as debt-service-to-income and loan-to-value limits or increased risk weights). Regulatory measures in Poland have been implemented in the form of recommendations issued by the Polish Financial Supervision Authority (PFSA). They have been applicable to all banks, both Polish and foreign owned (including branches). Even though they formally have a microprudential character, they have been issued with a reference to the systemic risk. A more detailed description of the Polish experience with tools limiting credit growth can be found in Bierut et al. (2015). Other prudential actions taken in Poland include implementations of the EU regulations (CRDI-CRDIV), short- and long-term liquidity limits introduced in 2008, recommendations to maintain higher minimum capital ratios, and dividend restrictions.

2.2 Empirical Methodology

In the empirical analysis we examine whether Polish banks modify their activity in response to regulations in their home countries. The analysis explores the effect of changes in regulation on banks' loan growth, following the approach described in Buch and Goldberg (2017). We begin with the following regression specification (1):

$$\Delta Y_{b,j,t} = \alpha_0 + (\alpha_1 HomeP_{j,t} + \alpha_2 HomeP_{j,t-1} + \alpha_3 HomeP_{j,t-2}) + \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} + f_b + f_t + \epsilon_{b,j,t}, \quad (1)$$

where $\Delta Y_{b,j,t}$ is a quarterly growth rate of loans, and $X_{b,j,t-1}$ is a vector of control variables that captures the degree to which a bank b is exposed to changes in regulation of country j through ex ante balance sheet composition and market access. $Z_{j,t}$ represents the financial and business cycle variables for country j. Bank and time fixed effects are included.[3] The prudential policy changes are captured by $HomeP_j$ prudential policy in the home country of the parent bank. Detailed definitions of the variables used can be found in table 10 in the appendix.

The above specification does not take into account the possibility that the response to home-country policy may not be homogenous

[3]In the Polish case, as we focused only on inward transmission, this specification accounts also for the time-country fixed effect.

across all banks in the sample. To do this, we supplement the previous specification with the interactions. As the model includes bank and time fixed effects, the coefficient on the interaction term $HomeP_j \cdot X_b$ measures how the structure of banks' balance sheets affects the response of bank lending to changes in regulation. The specification looks as follows:

$$\begin{aligned}\Delta Y_{b,j,t} = \alpha_0 &+ (\alpha_1 HomeP_{j,t} + \alpha_2 HomeP_{j,t-1} + \alpha_3 HomeP_{j,t-2}) \\ &+ \alpha_4 X_{b,j,t-1} + \alpha_5 Z_{j,t} + (\beta_1 HomeP_{j,t} \cdot X_{b,t-1} \\ &+ \beta_2 HomeP_{j,t-1} \cdot X_{b,t-1} + \beta_3 HomeP_{j,t-2} \cdot X_{b,t-1}) \\ &+ f_b + f_t + \epsilon_{b,j,t}. \end{aligned} \tag{2}$$

Next, we use cumulative changes to identify whether a change in the policy restrictiveness since 2000 influences banks' credit extension. The interactions of prudential policy with the cycle allow us to assess whether the reaction to cumulative policy changes is stronger in the different phases of the real or financial cycle. The specification is given by

$$\begin{aligned}\Delta Y_{b,j,t} = \alpha_0 &+ \alpha_1 HomeP_{cum,b,t} + \alpha_2 X_{b,j,t-1} + \alpha_3 Z_{j,t} \\ &+ \alpha_4 HomeP_{cum,j,t} \cdot Z_{j,t} + f_b + f_t + \epsilon_{b,j,t}. \end{aligned} \tag{3}$$

Finally, we modify the first regression by substituting time fixed effects with host-country policy and cycle variables to determine whether explicitly accounting for domestic regulatory environment affects the results. The specification now looks as follows:

$$\begin{aligned}\Delta Y_{b,j,t} = \alpha_0 &+ (\alpha_1 HomeP_{j,t} + \alpha_2 HomeP_{j,t-1} + \alpha_3 HomeP_{j,t-2}) \\ &+ \alpha_4 X_{b,t-1} + \alpha_5 Z_{j,t} + \alpha_6 Z_{host,t} + (\beta_1 HostP_t \\ &+ \beta_2 HostP_{t-1} + \beta_3 HostP_{t-2} + f_b + \epsilon_{b,j,t}. \end{aligned} \tag{4}$$

2.3 Bank-Level Data

The main dependent variable used in this analysis is the change in log claims in the domestic private non-financial sector (measured at the individual level). We focus on lending to the private non-financial sector, as intrafinancial system loans do not play a significant role in Poland (at the end of 2014, claims on the financial sector of banks in

the sample accounted for less than 10 percent of all claims). We chose to analyze a broader category of claims (instead of only loans) mainly due to data availability; however, the results can be easily interpreted in terms of loans, since they represent the vast majority of claims on the non-financial sector (around 90–95 percent, depending on the period).

A set of standard International Banking Research Network (IBRN) bank controls is used as explanatory variables (proxies of size, liquidity, capitalization, and international funding all measured at the individual level) with two modifications. First, we use the capital adequacy ratio (total regulatory capital to risk-weighted assets) instead of the tier 1 ratio due to data availability. Secondly, we modified the construction of the *Net Intragroup Funding*$_{b,t-1}$ variable—which is here defined from the perspective of Polish banks (not head office), so bigger values mean the greater reliance of Polish subsidiaries on funds obtained from foreign headquarters (since we do not have data on intragroup flows, we use liabilities toward all foreign banks as a proxy). We believe that such a definition is more appropriate and intuitive in the context of a Polish banking sector that imports liquidity from abroad rather than exports it, and for the aim of this research (analysis of inward transmission through foreign-owned banks).[4] The precise definitions of the variables used, together with the data sources, can be found in table 10 in the appendix.

We used quarterly supervisory reporting data on Polish commercial banks from the 2002–14 period for our baseline regressions. In principle, all commercial banks (both domestic and foreign owned) were included in the sample; however, adjustments were made to ensure that the results were not affected by outliers. First, special-case banks (state-owned special-purpose banks and affiliating banks) were removed from the sample. Second, to account for the impact of mergers on a bank's balance sheets, a new entity with a new identifier was created every time two banks merged. Third, any observations for which quarterly lending growth exceeded 100 percent were dropped. Fourth, remaining outliers were excluded by removing the

[4]At the same time, our definition is not very different from that of the standard IBRN and therefore this modification should not affect the comparability of results.

Table 1. Descriptive Statistics

Variable	Mean	Median	SD
Δ Domestic Claims	2.7	2.3	6.4
Log Total Assets	15.5	15.4	1.7
Capital Adequacy Ratio (%)	17.7	13.9	14.5
Illiquid Assets Ratio (%)	83.3	85.6	14.5
Net Intragroup Funding (%)	6.5	0.0	22.2
Core Deposits Ratio (%)	22.4	19.2	21.7

Table 2. Correlations between Banks' Characteristics

	Log Total Assets	Capital Adequacy Ratio	Illiquid Assets Ratio	Net Due To
Capital Adequacy Ratio	−0.3763	1.0000		
Illiquid Assets Ratio	−0.4254	0.1493	1.0000	
Net Due To	−0.0310	−0.0695	0.1118	1.0000
Core Deposits Ratio	0.4799	−0.2486	−0.2195	−0.2118

Note: See table 10 in the appendix for the definitions of variables.

10 percent of observations with the highest absolute quarterly change in claims. Finally, series with less than eight consecutive quarters of observations were dropped. The remaining banks account for around 80 percent of total claims on the non-financial sector.

Table 1 presents the descriptive statistics of the variables used. They confirm that the Polish banking system is relatively traditional—assets mostly comprise loans to the non-financial sector, which is reflected in a high illiquid assets ratio. Most of the funding comes in the form of retail deposits—as documented by a relatively high core deposits ratio. Although in general, foreign (intragroup) funding does not play a great role, it is important for some banks (as reflected in the high standard deviation). As table 2 shows, bigger banks tend to be less liquid (as they focus on granting long-term loans), to be less dependent on foreign financing, and to rely more on deposit funding.

2.4 Data on Prudential Instruments

The main explanatory variables of interest in this study are those that capture changes in prudential policies in the home countries of Polish foreign-owned banks, as given in Cerutti et al. (2017). Different policy variables that we use capture the change either in the individual instruments or in the overall prudential policy (through a prudential index that indicates whether any of the seven individual prudential policies is being changed in a given quarter). All policy indicators are discrete variables with values varying between –1 and 1, with one exception—reserve requirements in local currency vary between –3 and +5 to capture the change intensity. Not all the individual instruments are, however, taken into account in the regressions—in some cases, there is no variation in the instrument (either it has never been introduced or this type of policy has never been tightened or relaxed in the sample period), so it cannot be included in the regressions.

Table 3 presents the statistics for the use of prudential policies by the regulators in individual countries over the 2000–14 period. They show that the most frequently changed regulations were general capital requirements and loan-to-value (LTV) limits. At the other end are the reserve requirements in foreign currency, which have not been changed since 2000 and are therefore not included in the analysis.

The host-country (Polish) policy is also explicitly controlled for in this paper. Again, both the general prudential policy measure and the individual instruments are included in the regressions, provided that there is any variation in a given type of policy (there is at least one change in the sample period). Reserve requirements in foreign currencies and interbank exposure limits in Poland were not changed in the sample period and therefore are not taken into account.

3. Regression Results

3.1 Baseline Analysis of Inward Transmission of Prudential Policies

Our empirical results show that tightening of prudential regulations in home countries does not impact credit growth in Poland—all the coefficients next to contemporaneous and lagged prudential index are

Table 3. Summary Statistics on Changes in Prudential Instruments

Instrument	No. of Country-Time Changes	No. of Country-Time Changes (Tightening)	No. of Country-Time Changes (Loosening)	No. of Bank-Time Changes
Prudential Index	52	43	9	110
General Capital Requirements	28	28	0	53
Sector-Specific Capital Buffer (Real Estate)	4	3	1	5
Loan-to-Value Ratio Limits	12	8	4	19
Reserve Requirements: Foreign Currency	0	0	0	0
Reserve Requirements: Local Currency	9	0	9	23
Interbank Exposure Limit	5	5	0	30
Concentration Ratios	8	8	0	24

Source: IBRN.
Notes: This table shows summary statistics on changes in prudential instruments for banks located in Poland over the period 2000–14. Data on the instruments come from the IBRN Prudential Instruments Database, described in Cerutti et al. (2017), and are on a quarterly level. The number of changes in prudential instruments is reported on several dimensions: on the country-time level and on the bank-time level. The reported data are based on the regression sample.

not significant (see table 4; the results are based on the first specification described in section 2.2). The prudential index, however, is an aggregate measure and does not inform us about the type of policy being changed. Therefore, as we may expect that individual regulatory actions will have a different impact on the credit extension in Poland (see, for example, table 1 in Buch and Goldberg 2017), we have to consider each instrument separately as well. Out of the six different regulations that we control for in our analysis, we focus in particular on the selected instruments that may have the biggest impact on credit extension in Poland.

Changes in consolidated capital requirements may negatively affect credit growth of Polish banks if parent banks decide to decrease groups' risk-weighted assets by shrinking portfolios of their subsidiaries. Buch and Goldberg (2017) also show that global banks may increase international activities and move to less regulated markets if the requirements are not imposed at the consolidated level or are not binding; however, we do not expect this mechanism to be important in the Polish case. Reserve requirements serve as funding restrictions, but they can also be treated as an alternative to change in capital requirements (see, for example, Buch and Goldberg 2017) and therefore can affect credit extension in other than domestic jurisdictions as well. Restrictions on interbank exposures and concentration limits aim at decreasing interconnectedness and limiting potential contagion stemming from the default of a single client, and therefore we do not expect them to have a direct impact on the cross-border operations of the whole banking group. The same applies to loan-to-value limits that are product-level regulations and are unlikely to affect credit extension in Poland (see Buch and Goldberg 2017).

We find that tightening capital requirements in home countries significantly decreases lending growth of Polish banks by nearly 1.4 percentage points two quarters after the policy change. Such result could reflect the locational pecking-order strategy of international banks (a hypothesis formulated in Cetorelli and Goldberg 2012) which, in response to tighter regulatory standards in home countries, choose to save their home markets and cut lending in foreign locations first. Yet, we do not know from our analysis whether there is a difference between lending activity of the same bank in different locations, and caution is needed when interpreting the results in

Table 4. Inward Transmission of Policy via Affiliates of Foreign-Owned Banks

	Prudential Index (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	LTV Ratio (4)	Reserve Requirements: Local Currency (5)	Interbank Exposure Limits (6)	Concentration Ratios (7)
Prudential Policy$_t$	0.476	−0.638	−2.337	1.195	3.506**	−0.598	1.051
	(0.431)	(0.734)	(2.310)	(1.575)	(1.502)	(0.693)	(0.765)
Prudential Policy$_{t-1}$	0.723	0.257	−1.032	−0.524	3.002**	0.203	1.350
	(0.731)	(0.739)	(2.400)	(0.925)	(1.210)	(0.797)	(0.963)
Prudential Policy$_{t-2}$	−0.467	−1.377**	0.984	2.637***	1.472	−1.624**	−0.964
	(0.432)	(0.583)	(1.925)	(0.749)	(1.261)	(0.587)	(0.737)
Observations	1,909	1,909	1,909	1,909	1,909	1,909	1,909
R^2	0.309	0.309	0.308	0.309	0.310	0.308	0.309
Adjusted R^2	0.258	0.258	0.257	0.259	0.260	0.258	0.258
No. of Banks	72	72	72	72	72	72	72

Notes: This table reports the effects of changes in regulation on log changes in total claims on the domestic non-financial sector. The data are quarterly from 2002:Q1 to 2014:Q4. Each column gives the result for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates. For more details on the variables, see the online appendix at http://www.ijcb.org. All specifications include time and bank fixed effects. Standard errors are shown in parentheses and are clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. All banking data are at the individual level. Both domestic and foreign-owned banks are included in the sample. Only selected results (variables) are presented here; full results are available in the online appendix.

this way. The effect is also in line with the findings of Aiyar et al. (2014), who document the negative impact of home-country capital requirements on the cross-border operations of banks (their research shows that increasing capital ratios by 100 basis points reduces growth rate in cross-border lending of U.K. banks by 5.5 percentage points).

The positive relationship between tightening reserve requirements in local currency in home countries and credit extension in Poland that we find (see table 4) is counterintuitive and difficult to explain. Reserve requirements are used by prudential authorities to limit credit growth (see, for example, Tovar, Garcia-Escribano, and Martin 2012 or Cordella et al. 2014 for a discussion and evidence on the use of reserve requirements for macroprudential purposes). As they work in a similar way to capital buffers, we were expecting the coefficient to have the same (negative) sign as the one next to the capital requirements. This result can be, however, biased—in our sample there was no single event of tightening in reserve requirements in local currency in any of the home countries of Polish banks (see table 3).

Among the individual characteristics of banks that can shape their response to the home-country regulations, we find that banks that hold more illiquid assets or to a bigger extent rely on intragroup funding react more to the tightening of capital requirements (see table 5). When international banks decide to deleverage, subsidiaries relying on funding from parent institutions are naturally more vulnerable to changes in the home-country regulations. If, at the same, they do not have enough liquid assets, they may find it hard to substitute this funding, e.g., with repo transactions. Also, the low illiquid assets ratio means that a balance sheet comprises mostly liquid assets (for example, government bonds or central bank bills) and the loan portfolio is relatively small. Thus, scaling down lending growth of such banks would not bring large benefits to the group. That could potentially explain why banks with a relatively bigger loan portfolio and higher illiquid assets ratio are more sensitive to the tightening of capital regulations in home countries of their parent banks. The share of illiquid assets in a bank's balance sheet is also found to affect the transmission of reserve requirements. In this setting, however, we do not find a significant average impact of changes in any of the regulations in home country on credit extension

Table 5. Inward Transmission of Policy with Banks' Characteristics

	Prudential Index (1)	**Capital Requirements (2)**	**LTV Ratio (3)**	**Reserve Requirements: Local (4)**	**Interbank Exposure Limits (5)**	**Concentration Ratios (6)**
Prudential Policy$_t$	−25.95***	−6.218	−51.59	−21.50	−26.02***	8.834
	(7.431)	(6.054)	(42.11)	(15.18)	(5.505)	(11.15)
Prudential Policy$_{t-1}$	−7.217	10.48	−27.29	−12.88	16.72***	−26.82
	(13.73)	(11.10)	(52.35)	(12.17)	(5.435)	(24.28)
Prudential Policy$_{t-2}$	−12.94	16.50	27.90	−26.60***	7.159*	14.79
	(7.601)	(17.26)	(47.47)	(5.298)	(3.788)	(21.95)
Log Total Assets* Prudential Policy	2.575	0.529	0.389	1.998	0.997	−0.362
p-value	*0.00569*	*0.655*	*0.966*	*0.141*	*0.161*	*0.778*
Capital Adequacy Ratio* Prudential Policy	0.220	0.183	0.0644	0.132	0.209	−0.262
p-value	*0.0217*	*0.172*	*0.903*	*0.586*	*0.172*	*0.337*
Illiquid Assets Ratio* Prudential Policy	0.0731	−0.350	0.472	0.409	−0.206	0.246
p-value	*0.606*	*0.0103*	*1.14e-05*	*0.00273*	*0.00181*	*0.228*
Net Intragroup Funding* Prudential Policy	−0.0914	−0.132	0.115	0.0191	−0.127	−0.181
p-value	*0.122*	*0.0833*	*0.642*	*0.747*	*0.215*	*0.0835*

(*continued*)

Table 5. (Continued)

	Prudential Index (1)	Capital Requirements (2)	LTV Ratio (3)	Reserve Requirements: Local (4)	Interbank Exposure Limits (5)	Concentration Ratios (6)
Core Deposits Ratio* Prudential Policy	−0.0944	−0.153	0.336	−0.0257	0.0329	−0.0697
p-value	*0.140*	*0.166*	*0.622*	*0.783*	*0.714*	*0.736*
Observations	1,836	1,836	1,836	1,836	1,836	1,836
R^2	0.326	0.326	0.321	0.322	0.321	0.319
Adjusted R^2	0.270	0.269	0.265	0.266	0.265	0.263
No. of Banks	72	72	72	72	72	72
Net Effect	1.060	−1.228	3.800	5.963	−0.267	4.322
p-value	*0.417*	*0.415*	*0.456*	*0.114*	*0.895*	*0.217*

Notes: This table reports the effects of changes in regulation and their interactions with bank characteristics on log changes in claims on the domestic non-financial sector. The data are quarterly from 2002:Q1 to 2014:Q4. Each column gives the results for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates. For more details on the variables, see the online appendix. All specifications include time and bank fixed effects. Standard errors are clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. All banking data are at the individual level. Both domestic and foreign-owned banks are included in the sample. Sectoral-specific capital buffers are not included due to collinearity. Reported interactions are the sum of interactions of contemporaneous and lagged coefficients next to policy variables with respective bank control; p-values shown are reported from an F-test that the given linear combination is equal to 0. The net effect is the linear combination of all instrument coefficients (contemporaneous and lagged) with interacted controls fixed at their mean levels; p-values are reported from an F-test that the given linear combination is equal to 0.

of Polish banks—the net effect, which is the linear combination of all instrument coefficients with interacted controls fixed at their mean levels, is not significant for any instrument (see the last row of table 5 for the F-statistics and p-value).

As a next step we consider how cumulative changes in prudential policies affect lending growth in different phases of the real and financial cycle. We find that the cumulative tightening of policy (as measured with the cumulative prudential index) significantly decreases the growth rate of lending in Poland by 0.8 percentage points (see table 6). Both financial and real financial cycle conditions in home countries matter for the transmission; the business cycle amplifies the transmission of prudential policy more than the financial cycle. Among the individual instruments, cumulative changes in capital requirements work in a similar fashion as found previously (for example, table 4)—their tightening reduces the quarterly lending growth of Polish banks by nearly 1.7 percentage points (regardless of the cycles).

Finally, we explicitly control for the host-country (i.e., Polish) prudential policy in our regression (see specification (4) in section 2.2 and table 7). International banks operate in Poland mostly through subsidiaries and are subject not only to home-country policy but also (primarily) to Polish prudential regulations. Thus it is important to explicitly control for them in the regressions. In each case we put in the regression the same type of home- and host-country regulations. For example, when we investigate the impact of changes in capital requirements in home countries, we include also changes in capital requirements in Poland. In this setting, tightening capital requirements no longer affects credit extension in Poland. At the same time, Polish regulations in this area are found to be significant (they decrease lending growth by nearly 2.7 percentage points). This suggests that the decrease in credit growth can be attributed to changes in host-country capital requirements (that we did not properly control for in previous analysis) rather than in home-country policy. Recent actions taken by some international banks present in Poland suggest that in response to tightened capital policy at home, international banks might be more willing to decrease their cross-border operations and sell some of their subsidiaries.[5]

[5]For example, Italian Unicredito is said to have put its Polish subsidiary (Pekao S.A.) up for sale to meet higher capital requirements in response to the 2016 European Banking Authority EU-wide stress tests.

Table 6. Inward Transmission of Cumulative Policy Changes

	Prudential Index (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	LTV Ratio (4)	Reserve Requirements: Local (5)	Interbank Exposure Limits (6)	Concentration Ratios (7)
Cumulative Change in Prudential Policy	−0.825**	−1.653***	−2.736	0.220	1.065	−0.382	0.0243
	(0.289)	(0.366)	(1.824)	(0.533)	(0.698)	(0.807)	(0.481)
BIS Financial Cycle	−0.000976	0.0250	0.0212	0.00484	0.0384	−0.00936	0.0225
	(0.0301)	(0.0404)	(0.0484)	(0.0436)	(0.0569)	(0.0331)	(0.0381)
BIS Business Cycle	0.503**	0.346	0.220	0.279	0.319	0.364	0.282
	(0.208)	(0.249)	(0.249)	(0.217)	(0.296)	(0.269)	(0.244)
BIS Financial Cycle* Cumulative Change in Prudential Policy	0.0196**	−0.0578	0.0193	0.0310	0.0301	0.113	−0.0406
	(0.00679)	(0.0386)	(0.0320)	(0.0200)	(0.0379)	(0.0648)	(0.0367)
BIS Business Cycle* Cumulative Change in Prudential Policy	−0.240**	−0.384	0.306*	−0.0641	0.0729	0.0578	−0.449***
	(0.100)	(0.323)	(0.158)	(0.373)	(0.198)	(0.118)	(0.140)
Observations	1,972	1,972	1,972	1,972	1,972	1,972	1,972
R^2	0.301	0.296	0.294	0.292	0.293	0.303	0.294
Adjusted R^2	0.252	0.247	0.245	0.243	0.243	0.254	0.245
No. of Banks	72	72	72	72	72	72	72
Net Effect	−0.772	−1.624	−2.776	0.250	1.072	−0.322	0.0753
p-value	*0.0190*	*0.000621*	*0.152*	*0.621*	*0.142*	*0.703*	*0.873*

Notes: This table reports the effects of cumulative changes in regulation and their interactions with financial and business cycles on log changes in claims on the domestic non-financial sector. The data are quarterly from 2002:Q1 to 2014:Q4. Each column gives the results for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates. For more details on the variables, see the online appendix. All specifications include time and bank fixed effects. Standard errors are shown in parentheses and are clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. All banking data are at the individual level. Both domestic and foreign-owned banks are included in the sample. The net effect is the linear combination of all instrument coefficients with interacted controls fixed at their mean levels; p-values are reported from an F-test that the given linear combination is equal to 0. Only selected results (variables) are presented here; full results are available in the online appendix.

Table 7. Inward Transmission of Policy after Controlling for Host-Country Regulations

	Prudential Index (1)	Capital Requirements (2)	Sector-Specific Capital Buffer (3)	LTV Ratio (4)	Reserve Requirements: Local (5)	Concentration Ratios (6)
Home-Country Prudential Policy$_t$	0.361	−0.924	−2.398	0.557	4.486***	0.381
	(0.561)	(0.836)	(2.298)	(1.693)	(0.379)	(0.882)
Home-Country Prudential Policy$_{t-1}$	0.886	0.512	−1.573	0.213	0.545	1.261
	(0.787)	(1.118)	(2.667)	(0.926)	(0.838)	(1.271)
Home-Country Prudential Policy$_{t-2}$	0.135	−1.184	1.285	2.809***	1.949*	−1.033
	(0.525)	(0.925)	(2.423)	(0.917)	(0.914)	(0.617)
Host-Country Prudential Policy$_t$	−0.0136	−2.765**	0.231	0.278	1.235**	−1.079
	(0.181)	(1.203)	(0.151)	(1.130)	(0.498)	(0.965)
Host-Country Prudential Policy$_{t-1}$	0.318	0.622	−0.305*	1.210	−0.161	2.137**
	(0.276)	(0.976)	(0.147)	(1.548)	(0.507)	(0.911)
Host-Country Prudential Policy$_{t-2}$	0.287	−0.943	−0.525*	0.254	0.629	3.134***
	(0.257)	(0.636)	(0.247)	(0.883)	(0.503)	(0.880)
Observations	1,836	1,836	1,836	1,836	1,836	1,836
R^2	0.256	0.262	0.257	0.256	0.263	0.263
Adjusted R^2	0.220	0.226	0.221	0.220	0.228	0.227
No. of Banks	72	72	72	72	72	72

Notes: This table reports the effects of changes in parent-country regulation and firm characteristics on log changes in claims on the domestic non-financial sector. The data are quarterly from 2002:Q1 to 2014:Q4. Each column gives the results for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates and in the host country (i.e., Poland). For more details on the variables, see the online appendix. All specifications include bank fixed effects only. Standard errors are reported in parentheses and clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. All banking data are at the individual level. Interbank exposure limits are dropped due to collinearity. Both domestic and foreign-owned banks are included in the sample. Only selected results (variables) are presented here; full results are available in the online appendix.

3.2 Robustness Checks and Country-Specific Issues

In this section we explore the robustness of our findings and consider whether they hold after taking into account specific features of the Polish banking sector. First, as a large share of a loan portfolio is denominated in foreign currencies (mainly CHF) and therefore is vulnerable to changes in the exchange rate, we run baseline specifications using change in claims net of exchange rate fluctuations as a dependent variable. The conclusions do not change significantly (see table 8, columns 1–4)—we find a significant, negative impact of cumulative changes in prudential policy and lagged capital requirements.

Next, we investigate policy spillovers in the post-crisis period only. There are two motivations for that: the majority of the prudential actions were taken after 2008, and this was the post-crisis period when the public debate in Poland concentrated on the possible drawbacks of the dominance of foreign-owned banks (see section 2.3). Differences in credit extension between domestic and foreign-owned banks were also noted during this period (the median growth rate of claims in the post-crisis period for foreign-owned banks was –0.14 compared with 2.97 for Polish-owned banks). Table 8, columns 5–6, presents the results. Changing the sample does not significantly affect the conclusions from the baseline regressions. Capital requirements still seem to have a negative impact on lending (now only in the peak of the financial cycle), but we no longer find an impact of the cumulative changes in general prudential policy.

We then examined whether changes in the regulatory policy in home countries influenced the risk taking of Polish banks. We build on a vast literature related to the risk-taking channel of monetary policy. In line with Laeven and Levine (2009) or Houston et al. (2010), we proxy risk taking with the logarithm of a z-score (defined as return on assets (ROA) plus capital-to-assets ratio, divided by the standard deviation of ROA—see table 10 in the appendix for details). The higher the z-score, the less the bank is likely to default (less risky). Significant and negative coefficients could therefore be interpreted as supporting the risk-shifting hypothesis formulated by Ongena, Popov, and Udell (2013) and suggest that banks compensate for the inability to take more risks at home by increasing lending in less regulated locations. Table 9 provides some evidence that tightening reserve requirements or capital ratios in the home country

Table 8. Robustness Checks

	Capital Requirements (1)	Prudential Index (2)	Capital Requirements (3)	Prudential Index (4)	Capital Requirements (5)	Prudential Index (6)
Home-Country Regulation$_t$			−0.949	0.152		
			(0.741)	(0.542)		
Home-Country Regulation$_{t-1}$			−0.291	1.017		
			(0.696)	(0.684)		
Home-Country Regulation$_{t-2}$			−1.393*	−0.168		
			(0.764)	(0.542)		
Cumulative Change in Prudential Policy	−2.190***	−0.991***			0.215	−0.281
	(0.323)	(0.270)			(0.520)	(0.401)
BIS Financial Cycle* Cumulative Change in Prudential Policy	−0.0657	0.0148			−0.0653*	−0.00192
	(0.0492)	(0.0122)			(0.0343)	(0.0152)
BIS Business Cycle* Cumulative Change in Prudential Policy	−0.571	−0.181**			−0.351	−0.320
	(0.444)	(0.0799)			(0.272)	(0.229)
Observations	1,972	1,972	1,972	1,858	832	832
R^2	0.309	0.312	0.328	0.328	0.455	0.454
Adjusted R^2	0.263	0.265	0.280	0.280	0.397	0.396
No. of Banks	72	72	72	72	50	50
Time Period	2002:Q1–2014:Q4	2002:Q1–2014:Q4	2002:Q1–2014:Q4	2002:Q1–2014:Q4	2009:Q1–2014:Q4	2009:Q1–2014:Q4
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
LHS Variable	FX Adjusted Claims	FX Adjusted Claims	FX Adjusted Claims	FX Adjusted Claims	Claims	Claims
Sample	Full	Full	Full	Full	Post-crisis	Post-crisis

Notes: Each column gives the results for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates. For more details on the variables, see the online appendix. All specifications include bank fixed effects as specified in the lower part of the table. Standard errors are clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively.

Table 9. Impact of Regulations on Risk Taking

	Capital Requirements (1)	Reserve Requirement Local (2)	LTV Ratio (3)	Reserve Requirements: Local (4)	Interbank Exposure Limits (5)	Concentration Ratios (6)
Home-Country Regulation$_t$	−0.911*	−0.351***				
	(0.438)	(0.0358)				
Home-Country Regulation$_{t-1}$	−1.019**	−0.453***				
	(0.465)	(0.0403)				
Home-Country Regulation$_{t-2}$	−0.967**	−0.504***				
	(0.435)	(0.0386)				
Cumulative Home-Country Regulation			0.00601	0.0193	−0.255	0.0295
			(0.0246)	(0.0548)	(0.153)	(0.0555)
BIS Financial Cycle* Cumulative Home-Country Regulation			−0.00422	0.0191	−0.0306*	0.0101
			(0.0146)	(0.0163)	(0.0152)	(0.00709)
BIS Business Cycle* Cumulative Home-Country Regulation			−0.000661	−0.00497	−0.0196	−0.00231
			(0.00176)	(0.00547)	(0.0139)	(0.00529)
Observations	2,261	2,261	2,309	2,309	2,309	2,309
R^2	0.730	0.695	0.928	0.929	0.931	0.928
Adjusted R^2	0.719	0.681	0.924	0.924	0.926	0.924
No. of Banks	72	72	72	72	72	72
Time Fixed Effects	No	No	No	Yes	Yes	Yes
Bank Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
LHS Variable	Risk Taking	Risk Taking	Risk Taking	Risk Taking	Risk Taking	Risk Taking

Notes: This table reports the effects of changes in parent-country regulation and firm characteristics on risk taking, depending on specification. The data are quarterly from 2002:Q1 to 2014:Q4. Each column gives the results for the change in the regulatory measure specified in the column headline in the home (i.e., parent-bank) country of foreign affiliates and in the host country (i.e., Poland). For more details on the variables, see the online appendix. All specifications include bank fixed effects as specified in the lower part of the table. Standard errors are clustered by country. ***, **, and * indicate significance at the 1 percent, 5 percent, and 10 percent level, respectively. All banking data are at the individual level.

leads to an increase in risk taking in the Polish banking sector. This may reflect the strategy of compensating for the inability to increase ROA at home.

Finally, all the policy instruments except for the prudential index are put into an equation to examine how good the index is as a proxy for overall policy change, and to see if the baseline conclusions regarding the impact of cumulative changes in general policy hold. The results (not reported here) suggest that none of the policy variables is significant; however, during economic recovery, a tightening of concentration regulations may decrease the credit expansion of Polish banks, while stricter LTV limits in the peak of the financial cycle may increase lending growth.

4. Concluding Remarks

In many economies that are host countries to international banks, policymakers have to take into account the possibility that the operation of banks (mainly credit extension) can be affected by the changes in regulatory environment in the home countries of foreign-owned banks (inward transmission of prudential policy). It is especially important for countries like Poland, where foreign banks have a dominant market position. After the global financial crisis, the debate in Poland reflected concerns about possible negative effects of several home-country regulations (mainly capital requirements) on the supply of credit in Poland.

Our results do not confirm the existence of a strong significant negative impact of home-country regulations on the dynamics of credit extension in Poland. When we control for domestic regulations that are binding for most of the banks in our sample, we do not find a significant impact of changes in the home-country capital requirements. However, it looks as if these are not single changes in regulations that may impact credit extension, but rather cumulative restrictiveness of regulatory environment.

For Polish regulators, the lack of significant inward transmission of prudential policy, together with the significance of local prudential actions, is a favorable situation. It means that changes in regulatory environment in different locations are not contributing to the credit crunch in Poland (the credit growth is not negatively affected), as international banks seem to take into account the situation in individual locations when trying to comply with the regulatory restrictions at home.

Appendix

Table 10. Construction of Balance Sheet Independent Variables

Variable Name	Description	Data Source
$\Delta Y_{b,t}$	Change in Claims on the Domestic Non-financial Sector = ln(Claims on Domestic Non-financial Sector) – Lag.ln(Claims on Domestic Non-financial Sector)	Supervisory Reporting
z-score$_{b,t}$	$z\text{-}score_{b,t} = \frac{ROA_{b,t} + \frac{capital_{b,t}}{assets_{b,t}}}{\sigma(ROA_b)}$, where $ROA_{b,t}, capital_{b,t}$, and $assets_{b,t}$ are measured for each bank and each quarter; $\sigma(ROA_b)$ is a standard deviation of ROA calculated for the whole sample period. ROA is calculated as a net profit of a given quarter relative to mean assets in a given quarter.	Supervisory Reporting
Log Total Assets$_{b,t-1}$	Logarithm of Total Assets	Supervisory Reporting
Capital Adequacy Ratio$_{b,t-1}$	Capital Adequacy Ratio = Regulatory Capital/ Risk-Weighted Assets, in %	Supervisory Reporting
Illiquid Assets Ratio$_{b,t-1}$	Illiquid Assets/Total Assets, in %, where Illiquid Assets = Total Assets, Government Bonds, Central Bank Bonds, Cash	Supervisory Reporting
Net Intragroup Funding$_{b,t-1}$	(Liabilities Toward Non-resident Banks Claims on Non-resident Banks)/Assets, in %	Supervisory Reporting
Core Deposits$_{b,t}$	Core Deposits/Assets, in %, where Core Deposits = Deposits from the Resident Household Sector	Supervisory Reporting

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